MULTIMEDIA UNIVERSITY

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FINAL EXAMINATION

TRIMESTER 2, 2019/2020

EME4066 – OPERATIONS RESEARCH
(ME)

11 MARCH 2020
2.30 p.m – 4.30 p.m
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 5 pages with 4 Questions only.

2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please write all your answers in the Answer Booklet provided.

Question 1:

Syntex is a company which manufactured custom made shoe cabinets either using melamine material or 4G glass material. Both of the shoe cabinets uses aluminium framework. They earn RM 180 profit for each melamine shoe cabinet sold and RM90 profit for each 4G glass shoe cabinet sold. In order to manufactured the shoe cabinet per unit the total material allocated by Syntex is at most 6kg wood material, 4kg glass material and aluminium 48kg material. The total resources usage per unit of activity is summarized in Table 1.

Table 1

Resources	Resource Usage per Unit	
	Melamine	4G glass
Aluminium	6	8
Glass	0	1
Wood	1	0

(i) Formulate the linear programming for the above problem.   **[5 marks]**

(ii) Determine the optimal solution using graphical method.   **[7 marks]**

(iii)State the dual of the above linear programming problem.   **[4 marks]**

(iv)Using the optimal solution obtain from part (ii), use the Duality theorem and the principle of complementary slackness to find optimal solution to the dual linear programming problem.   **[9 marks]**

Continued.......

Question 2:

(a) F & N company operates 2 different plants to produce canned fruits. The company deal with three different suppliers and they are willing to supply fresh fruits in the following quantity as listed in Table 2. The shipping costs to transport from the supplier to both the plants of the fresh fruits per kg are listed in Table 3. Table 4 detailed both plants capacities and the labour costs to process fresh fruits per kg. The canned fruits are sold at RM 65/kg to the distributors. The company can sell at this price all they can produce.

Table 2

Supplier	Fresh fruits (kg)	Cost per unit kg
S_1	250	RM 12
S_2	360	RM 9
S_3	475	RM 7.50

Table 3

From \ To	Plant A	Plant B
S_1	4	4.5
S_2	1	1.5
S_3	7	5

Table 4

	Plant A	Plant B
Capacity	500 kg	600 kg
Labour cost	RM 30/kg	Rm 27/kg

Formulate the above problem as a linear programming.   **[12 marks]**

(b)

$$\text{Maximize } z = 2x_1 + 3x_2 + 2x_3$$

subject to:

$$x_1 + 2x_2 + x_3 \leq 4$$
$$3x_1 + x_2 + x_3 \leq 5$$
$$x_1 + x_2 + 2x_3 \leq 4$$
$$x_1 + x_2 + x_3 \leq 3$$
$$x_1 \geq 0$$
$$x_2 \geq 0$$
$$x_3 \geq 0$$

(i) Formulate this problem to fit our standard form for linear programming.

         [5 marks]

(ii) Determine the optimal solution by using simplex method.   **[8 marks]**

Continued.......

Question 3:

(a) Panda food delivery collect their deliveries from three major food centres and deliver to 4 different areas. They collect the food from centre A, B and C and transport to four different areas 1, 2, 3, 4. The shipping cost is based on the mileage between the centre and the area destinations are summarized in Table 5. The unit of transportation costs are in RM.

Table 5

Center		Area				SUPPLY
		1	2	3	4	
	A	RM 500	RM 750	RM 300	RM 450	12
	B	RM 650	RM 800	RM 400	RM 600	17
	C	RM 400	RM 700	RM 500	RM 550	11
Demand		10	10	10	10	

Find the initial solution using the

(i)   Least cost method.   **[3 marks]**
(ii)   Vogel's Approximation method.   **[3 marks]**
(iii)   Using the VAM initial feasible solution, find the optimal solution using the modified distribution method (MODI).
                                                                        [9 marks]

(b) Jusco has built a new shopping complex and wishes to decide how to place their main four departments in four different locations in order to maximize the total profits. The table below gives the profits, in thousands of Ringgit Malaysia, when the departments are allocated to the various locations. Use the Hungarian method to obtain the optimal solution.   **[10 marks]**

		Location			
		1	2	3	4
Department	Housewares	24	20	26	22
	Clothing	29	32	19	25
	Shoes	31	24	27	30
	Toys	28	26	27	26

Continued.......

Question 4:

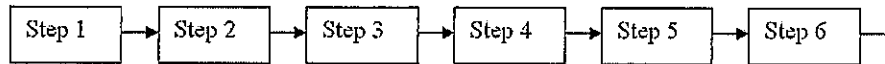a) Consider the process shown in **Figure Q4** is trying to produce to meet a market demand of 250 units per week.

| Step 1 | → | Step 2 | → | Step 3 | → | Step 4 | → | Step 5 | → | Step 6 | → |

Figure Q4

where is;

Step 1: Material release schedule

Step 2: Drilling (capacity is 300 units/ week)

Step 3: Tapping (capacity is 150 units/ week)

Step 4: Grinding (capacity is 300 units/week)

Step 5: Coating (capacity is 200 units/week)

Step 6: Inspection (capacity is 500 units/week)

i. Where should buffers be placed?   **[3 marks]**

ii. Which resource functions as a drum?   **[3 marks]**

iii. Where should the rope be placed?   **[3 marks]**

(b) Flextronic Sdn. Bhd. is planning a new warehouse to serve the South of Malaysia; Melaka, Negeri Sembilan and Johor states are under consideration. For each location, annual fixed costs (rent, equipment, and insurance) and average variable costs per shipment (labor, transportation, and utilities) are listed in Table 6. Sales projections range from 550,000 to 600,000 shipments per year.

Table 6

Location	Annual Fixed Costs (RM)	Variable Costs per Shipment (RM)
Melaka	5,000,000	4.65
Negeri Sembilan	4,200,000	6.25
Johor	3,500,000	7.25

i. Plot the total curves for all the locations on a single graph.   **[11 marks]**

ii. Which state provides the lowest overall costs? Justify your answer.   **[5 marks]**

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